

**INTERIM REPORT:
CAERNARVON FRESHWATER DIVERSION
CONTAMINANTS MONITORING STUDY
1990-1991**

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ABSTRACT

The Caernarvon Freshwater Diversion Structure was completed in January 1991 by the U.S. Army Corps of Engineers. The purpose of the structure is to divert Mississippi River water into the Breton Sound area estuary in southeastern Louisiana, to ameliorate saltwater intrusion and associated wetland loss. Biota were sampled in 1990 and 1991 to evaluate pre-diversion contaminant levels in fish and shellfish from the Mississippi River and three marsh locations (Big Mar, Grande Lake, and Bay Gardene) at increasing distances downstream from the structure outfall. Fish and oyster tissue samples were analyzed for residues of organochlorine pesticides, polychlorinated biphenyls, aliphatic hydrocarbons, and heavy metals.

Contaminant levels in biota collected prior to diversion will be compared to levels in biota collected following diversion, to evaluate changes in contaminant levels in fish and oysters that may be attributable to operation of the structure. The organochlorine and aliphatic hydrocarbons residues should be the most indicative of any deleterious effects upon the downstream biota, because these contaminants were observed either only in the Mississippi River, or at higher concentrations in the river. The marsh locations generally exhibited higher heavy metal concentrations than those of the Mississippi River.

Key words: Louisiana, Mississippi River, Breton Sound, organochlorine pesticides, PCBs, aliphatic hydrocarbons, heavy metals, freshwater diversion.

INTRODUCTION

The Breton Sound estuary is located in extreme southeast Louisiana, and its associated wetlands support a diversity of fish, shellfish, and wildlife populations of commercial importance to fisherman, trappers, sportsmen, and wildlife enthusiasts. These resources are being seriously threatened by habitat changes associated with marsh loss, subsidence, and saltwater intrusion. The U.S. Army Corps of Engineers (Corps) constructed the Caernarvon Freshwater Diversion Structure to divert Mississippi River (River) water into Breton Sound, in an attempt to reduce the rate of wetland loss, and to enhance fish and wildlife productivity by restoring salinity regimes to levels that previously occurred, i.e., when the River seasonally flooded the area.

The objective of this study is to evaluate pre- and post-diversion contaminant body burdens in fish and molluscs, at various locations in the Breton Sound estuary, to insure that the diversion is not contributing unacceptable contaminant levels to those resources. This interim report documents baseline contaminant levels in the study-area biota prior to diversion for comparison with such levels in biota to be sampled following diversion.

METHODS AND MATERIALS

During 1990 and 1991, fish samples were collected from the River at the site of the diversion, and near the outflow of the structure at Big Mar. Fish and oyster samples were collected at Grand Lake and Bay Gardene, located progressively further downstream from the outflow structure (Figure 1). Sites were selected to coincide as closely as possible with biological monitoring sites previously established by the Louisiana Department of Wildlife and Fisheries to determine wildlife population changes associated with the Diversion.

Fish samples were collected using trotlines and variable-mesh gill nets, and oyster samples were collected using a boat-towed oyster dredge. Fish were individually weighed and measured, wrapped in aluminum foil, labeled, bagged, and placed in frozen storage. Oyster samples were shucked using a stainless steel oyster knife; the tissue was weighed, transferred to a labeled, analytically-cleaned glass jar with a teflon-lined lid, and placed in frozen storage.

Heavy metals analyses were conducted by Research Triangle Institute, Research Triangle Park, North Carolina. Organic analyses were conducted by Mississippi State University, Starkville, Mississippi, according to contract specifications established by the U.S. Fish and Wildlife Service's Patuxent

Analytical Control Facility (PACF), Laurel, Maryland. All resultant data was reviewed and evaluated for accuracy by PACF as part of their quality control and assurance program. Methodologies for the various analyses are presented in Appendix A. Appendix Tables A-1 and A-2 display the Minimum Detection Limits for all organic and inorganic parameters, respectively.

RESULTS AND DISCUSSION

The results of the tissue analyses for the four sampling locations of the Caernarvon Freshwater Diversion Project are presented in Tables 1 through 6 and Appendix B, Tables B1 through B6.

Tables B1 through B6 display contaminant concentrations detected in each of the various organisms sampled from the Mississippi River (site 1), Big Mar (site 2), Grand Lake (site 3), and Bay Gardene (site 4). Organochlorine parameters for 1990 and 1991 are presented in Tables B1 and B2, respectively; aliphatic hydrocarbon parameters for 1990 and 1991 are presented in Tables B3 and B4, respectively; and inorganic parameters for 1991 are presented in Tables B5 and B6, respectively.

Tables 1 through 6 summarize the data presented in Tables B1 through B6, with organochlorine residue data summarized in Tables 1 and 2, aliphatic hydrocarbon residue data summarized in Tables 3 and 4, and inorganic residue data summarized in Tables 5 and 6.

Organochlorine Residues. The tissue samples were analyzed for 22 organochlorine residues. Twelve of these were non-detected in all tissue samples taken during both years of the study [α -benzene hexachloride (BHC), γ -BHC, β -BHC, δ -BHC, oxychlordan, toxaphene, o,p'-DDE, o,p'-DDD, endrin, cis-nonachlor, o,p'-DDT, and mirex]. Heptachlor epoxide and polychlorinated biphenyls (PCBs) were non-detected in the 1990 samples.

There were eight organochlorine residues detected only in the River: hexachlorobenzene (HCB), heptachlor epoxide (1991 only), γ -chlordan, τ -nonachlor, PCBs (1991 only), α -chlordan, dieldrin, and p,p'-DDT (1991 only). Only two organic compounds, p,p'-DDE and p,p'-DDD, were detected on both sides of the diversion structure. The p,p'-DDD was detected in the Mississippi River (mean=0.027 mg/kg) and at Big Mar (mean=0.001 mg/kg) in 1991 only, while p,p'-DDE was detected at all collection sites in both years. The highest concentration of p,p'-DDE always occurred in the River (mean=0.085 mg/kg in 1990 and 0.04 mg/kg in 1991), with lowest levels detected at Grand Lake in 1990 (mean=0.007 mg/kg) and Bay Gardene in 1991 (mean=0.003 mg/kg).

Aliphatic Hydrocarbon Residues. The tissue samples were analyzed for 13 aliphatic hydrocarbon residues which were detected at nearly all sampling locations. In both years, all aliphatic hydrocarbons exhibited a progression of decreasing concentrations, with the highest levels observed in the River and the lowest levels observed mainly in Bay Gardene. Two compounds, η -dodecane and η -tridecane, were detected only in the Mississippi River in 1990.

In comparing the three marsh locations, Grande Lake samples had elevated levels of octylcyclohexane in 1990; η -tridecane, nonylcyclohexane, η -heptadecane, and phytane in 1991; and pristane and η -eicosane in both years. Bay Gardene samples had an elevated level of η -pentadecane in 1990.

Inorganic Residues. Tissue samples were analyzed for 23 inorganic residues. Two parameters, silver and beryllium, were non-detected in 1990. There were no data for antimony, cobalt, silver, and tin in 1991 due to analytical problems; all other metals were detected at one or more stations.

Nearly all inorganic parameters (in both years) exhibited progressively increasing concentrations, with lower concentrations observed in the River and higher values occurring either in Grand Lake or Bay Gardene. Aluminum, barium, boron, cadmium, copper, iron, manganese, molybdenum, zinc, and arsenic values exhibited this progression. This trend was also observed for antimony, cobalt, and tin in 1990, and for beryllium and lead in 1991.

The lowest levels for magnesium and strontium (in both years) were observed in the Mississippi River, while the highest concentrations occurred at Big Mar. Vanadium and selenium concentrations decreased from the River to Big Mar, but levels at Bay Gardene were greater than those detected at the River.

Finally, the bioaccumulative ability of certain organisms in a sample can skew the data to indicate above normal levels of contamination. For example, the American oyster can bioaccumulate more efficiently than most fishes. The oyster's bioaccumulation ability is apparent in the data for aluminum, boron, copper, iron, cadmium, manganese, zinc, vanadium, selenium, and arsenic. This phenomenon can also be observed for certain fishes as with: chromium, iron, manganese, nickel, and vanadium in sheepshead; iron, nickel, and selenium in striped bass; and magnesium in spotted gar.

CONCLUSIONS

Organochlorine residues were found predominantly in samples from the River. The highest concentrations of aliphatic hydrocarbons, which were found throughout the system, also occurred in samples from the River. The heavy metals, were pervasive, but samples from the marsh locations generally exhibited higher concentrations. Now that the diversion structure is in operation, analysis of fish and wildlife samples should reveal any impacts of river diversion on specific contaminant levels in the receiving area.

This report completes the pre-diversion baseline contaminant sampling study. Post-diversion monitoring will begin after structure operations commence. Such operations should initially require opening the structure for sufficient flows and durations to assure that any contamination from the Mississippi River would be readily detectable.

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Table 1. Summary of organochlorine residues in tissue samples from the Caernarvon Freshwater Diversion monitoring sites for 1990 [values are the mean and range (in parentheses) expressed in mg/kg, dry weight].

PARAMETER	SAMPLING LOCATIONS			
	MISS. RIVER ¹	BIG MAR ²	GRAND LAKE ³	BAY GARDENE ⁴
HCB	0.025 (0.02-0.03)	BDL ⁵	BDL	BDL
α -BHC	BDL	BDL	BDL	BDL
γ -BHC	BDL	BDL	BDL	BDL
β -BHC	BDL	BDL	BDL	BDL
δ -BHC	BDL	BDL	BDL	BDL
OXYCHLOR	BDL	BDL	BDL	BDL
HEPT EPOX	BDL	BDL	BDL	BDL
γ -CHLOR	0.04 (0.03-0.05)	BDL	BDL	BDL
τ -NONACHL	0.035 (0.02-0.05)	BDL	BDL	BDL
TOXAPHENE	BDL	BDL	BDL	BDL
PCB's	BDL	BDL	BDL	BDL
<i>o,p'</i> -DDE	BDL	BDL	BDL	BDL
α -CHLOR	0.055 (0.05-0.06)	BDL	BDL	BDL
<i>p,p'</i> -DDE	0.085 (0.07-0.10)	0.013 (0.01-0.02)	0.007 (ND ⁶ -0.02)	0.015 (ND-0.02)
DIELDRIN	0.07 (0.05-0.09)	BDL	BDL	BDL
<i>o,p'</i> -DDD	BDL	BDL	BDL	BDL
ENDRIN	BDL	BDL	BDL	BDL
<i>cis</i> -NONAC	BDL	BDL	BDL	BDL

Table 1. Summary of organochlorine residues in tissue samples from the Caernarvon Freshwater (cont.) Diversion monitoring sites for 1990 [values are the mean and range (in parentheses) expressed in mg/kg, dry weight].

PARAMETER	SAMPLING LOCATIONS			
	MISS. RIVER ¹	BIG MAR ²	GRAND LAKE ³	BAY GARDENE ⁴
o,p'-DDT	BDL ⁵	BDL	BDL	BDL
p,p'-DDD	0.01 (0.01-0.01)	BDL	BDL	BDL
p,p'-DDT	0.06 (0.05-0.07)	BDL	BDL	BDL
MIREX	BDL	BDL	BDL	BDL

¹Values for the Mississippi River are calculated on the basis of one specimen of channel catfish and one specimen of blue catfish.

²Values for Big Mar are calculated on the basis of three specimens: two spotted gar and one largemouth bass.

³Values for Grand Lake are calculated on the basis of seven specimens: three oysters, two red drum, a spotted gar, and an alligator gar.

⁴Values for Bay Gardene are calculated on the basis of five specimens: three oysters, a red drum, and an alligator gar.

⁵BDL= Below detectable limit.

⁶ND= None detected.

Table 2. Summary of organochlorine residues in tissue samples from the Caernarvon Freshwater Diversion monitoring sites for 1991 [values are the mean and range (in parentheses) expressed in mg/kg, dry weight].

PARAMETER	SAMPLING LOCATIONS			
	MISS. RIVER ¹	BIG MAR ²	GRAND LAKE ³	BAY GARDENE ⁴
HCB	0.002 (ND ⁵ -0.01)	BDL ⁶	BDL	BDL
α -BHC	BDL	BDL	BDL	BDL
γ -BHC	BDL	BDL	BDL	BDL
β -BHC	BDL	BDL	BDL	BDL
δ -BHC	BDL	BDL	BDL	BDL
OXYCHLOR	BDL	BDL	BDL	BDL
HEPT EPOX	0.008 (ND-0.03)	BDL	BDL	BDL
α -CHLOR	0.007 (ND-0.02)	BDL	BDL	BDL
τ -NONACHL	0.012 (ND-0.02)	BDL	BDL	BDL
TOXAPHENE	BDL	BDL	BDL	BDL
PCB's	0.29 (0.17-0.42)	BDL	BDL	BDL
<i>o,p'</i> -DDE	BDL	BDL	BDL	BDL
α -CHLOR	0.017 (ND-0.03)	BDL	BDL	BDL
<i>p,p'</i> -DDE	0.04 (0.02-0.06)	0.007 (ND-0.02)	0.006 (ND-0.03)	0.003 (ND-0.01)
DIELDRIN	0.032 (ND-0.09)	BDL	BDL	BDL
<i>o,p'</i> -DDD	BDL	BDL	BDL	BDL
ENDRIN	BDL	BDL	BDL	BDL
<i>cis</i> -NONAC	BDL	BDL	BDL	BDL

Table 2. Summary of organochlorine residues in tissue samples from the Caernarvon Freshwater (cont.) Diversion monitoring sites for 1991 [values the mean and range (in parentheses) expressed in mg/kg, dry weight].

PARA-METER	SAMPLING LOCATIONS			
	MISS. RIVER ¹	BIG MAR ²	GRAND LAKE ³	BAY GARDENE ⁴
o,p-'DDT	BDL	BDL	BDL	BDL
p,p'-DDD	0.027 (0.01-0.04)	0.001 (ND ⁵ -0.01)	BDL	BDL
p,p'-DDT	BDL	BDL	BDL	BDL
MIREX	BDL	BDL	BDL	BDL

¹Values for the Mississippi River are calculated on the basis of one specimen of channel catfish and one specimen of blue catfish.

²Values for Big Mar are calculated on the basis of three specimens: two spotted gar and one largemouth bass.

³Values for Grand Lake are calculated on the basis of seven specimens: three oysters, two red drum, a spotted gar, and an alligator gar.

⁴Values for Bay Gardene are calculated on the basis of five specimens: three oysters, a red drum, and an alligator gar.

⁵ND= None detected.

⁶BDL= Below detectable limit.

Table 3. Summary of aliphatic hydrocarbon residues in tissue samples from the Caernarvon Freshwater Diversion monitoring sites for 1990 [values are the mean and range (in parentheses) expressed in mg/kg, dry weight].

PARA-METER	SAMPLING LOCATIONS			
	MISS. RIVER ¹	BIG MAR ²	GRAND LAKE ³	BAY GARDENE ⁴
η -DODECANE	0.04 (0.02-0.05)	BDL ⁵	BDL	BDL
η -TRIDECANE	0.04 (0.01-0.06)	BDL	BDL	BDL
η -TETRADECANE	0.14 (0.09-0.18)	0.003 (ND ⁶ -0.01)	0.001 (ND-0.01)	0.004 (ND-0.01)
OCTYLCHCLOHEXANE	0.08 (0.07-0.08)	BDL	0.02 (ND-0.05)	BDL
η -PENTADECANE	1.39 (0.28-2.5)	0.07 (0.05-0.09)	0.04 (ND-0.10)	0.06 (0.02-0.09)
NONYLCYCLOHEXANE	0.16 (0.12-0.19)	BDL	0.001 (ND-0.01)	BDL
η -HEXADECANE	0.75 (0.17-0.58)	0.007 (ND-0.01)	0.01 (ND-0.02)	0.01 (ND-0.02)
η -HEPTADECANE	3.75 (1.0-6.5)	0.14 (0.06-0.18)	0.14 (0.02-0.29)	0.07 (0.04-0.13)
PRISTANE	0.77 (0.24-1.3)	0.01 (ND-0.02)	0.07 (0.02-0.14)	0.01 (ND-0.02)
η -OCTADECANE	0.39 (0.15-0.62)	0.003 (ND-0.01)	0.01 (ND-0.01)	BDL
PHYTANE	0.21 (0.16-0.26)	0.02 (0.01-0.03)	0.01 (ND-0.02)	0.01 (ND-0.02)
η -NONADECANE	0.16 (0.06-0.25)	0.03 (0.02-0.04)	0.01 (ND-0.02)	0.004 (ND-0.02)
η -EICOSANE	0.08 (0.02-0.13)	0.003 (ND-0.01)	0.01 (ND-0.02)	BDL

¹Values for the Mississippi River are calculated on the basis of one specimen of channel catfish and one specimen of blue catfish.

²Values for Big Mar are calculated on the basis of three specimens: two spotted gar and one largemouth bass.

³Values for Grand Lake are calculated on the basis of seven specimens: three oysters, two red drum, a spotted gar, and an alligator gar.

⁴Values for Bay Gardene are calculated on the basis of five specimens: three oysters, a red drum, and an alligator gar.

⁵BDL= Below detectable limit.

⁶ND= None detected.

Table 4. Summary of aliphatic hydrocarbon residues in tissue samples from the Caernarvon Freshwater Diversion monitoring sites for 1991 [values are the mean and range (in parentheses) expressed in mg/kg, dry weight].

PARA-METER	SAMPLING LOCATIONS			
	MISS. RIVER ¹	BIG MAR ²	GRAND LAKE ³	BAY GARDENE ⁴
η -DODECANE	0.03 (ND ⁵ -0.05)	0.02 (ND-0.04)	0.02 (ND-0.04)	0.02 (ND-0.04)
η -TRIDECANE	0.07 (ND-0.22)	0.03 (0.01-0.05)	0.04 (ND-0.07)	0.03 (ND-0.04)
η -TETRADECANE	0.10 (0.02-0.22)	0.03 (0.01-0.04)	0.03 (ND-0.12)	0.02 (0.01-0.03)
OCTYLCHCLOHEXANE	0.03 (ND-0.07)	0.004 (ND-0.02)	0.002 (ND-0.01)	BDL ⁶
η -PENTADECANE	0.37 (0.13-0.82)	0.15 (0.03-0.16)	0.09 (ND-0.26)	0.04 (0.01-0.06)
NONYLCYCLOHEXANE	0.06 (0.01-0.16)	0.004 (ND-0.03)	0.02 (ND-0.20)	BDL
η -HEXADECANE	0.23 (0.03-0.71)	0.03 (ND-0.07)	0.04 (0.02-0.14)	0.03 (0.02-0.04)
η -HEPTADECANE	0.68 (0.19-0.68)	0.28 (ND-1.0)	0.64 (0.03-3.0)	0.04 (0.03-0.06)
PRISTANE	0.36 (0.06-0.51)	0.03 (ND-0.07)	0.07 (ND-0.85)	0.03 (0.01-0.08)
η -OCTADECANE	0.17 (0.02-0.52)	0.02 (ND-0.03)	0.03 (0.01-0.23)	0.01 (ND-0.02)
PHYTANE	0.15 (0.04-0.38)	0.05 (0.01-0.13)	0.08 (ND-0.70)	BDL
η -NONADECANE	0.13 (0.03-0.13)	0.04 (ND-0.12)	0.04 (ND-0.15)	0.01 (ND-0.02)
η -EICOSANE	0.09 (0.02-0.22)	0.01 (ND-0.03)	0.03 (ND-0.16)	0.03 (0.02-0.04)

¹Values for the Mississippi River are calculated on the basis of one specimen of channel catfish and one specimen of blue catfish.

²Values for Big Mar are calculated on the basis of three specimens: two spotted gar and one largemouth bass.

³Values for Grand Lake are calculated on the basis of seven specimens: three oysters, two red drum, a spotted gar, and an alligator gar.

⁴Values for Bay Gardene are calculated on the basis of five specimens: three oysters, a red drum, and an alligator gar.

⁵ND= None detected.

⁶BDL= Below detectable limit.

Table 5. Summary of elemental residues in tissue samples from the Caernarvon Freshwater Diversion monitoring sites for 1990 [values are the mean and range (in parentheses) expressed in mg/kg, dry weight].

PARA-METER	SAMPLING LOCATIONS			
	MISS. RIVER ¹	BIG MAR ²	GRAND LAKE ³	BAY GARDENE ⁴
Al	42.8 (38.5-47.1)	61.5 (<2.0-155.0)	121.7 (<2.0-365.0)	126.9 (<2.0-217.0)
Sb	BDL ⁵	BDL	BDL	1.06 (<5.0-5.3)
Ba	2.52 (0.75-4.28)	7.51 (3.69-10.6)	16.9 (8.13-29.1)	10.9 (8.64-11.7)
Be	BDL	BDL	BDL	BDL
B	BDL	1.96 (<0.8-3.21)	2.74 (<0.8-4.89)	5.94 (1.42-8.92)
Cd	BDL	BDL	1.83 (<0.15-4.34)	2.93 (<0.15-5.17)
Co	BDL	BDL	0.82 (<0.5-4.49)	0.419 (<0.5-0.996)
Cr	3.47 (0.59-6.35)	1.89 (1.74-2.06)	1.45 (0.73-2.12)	1.72 (1.02-2.15)
Cu	1.28 (0.66-1.89)	4.29 (2.05-7.18)	86.2 (2.42-217.0)	93.5 (2.26-161.0)
Fe	127.0 (124.0-130.0)	104.0 (72.0-120.0)	250.8 (83.3-449.0)	225.4 (92.1-314.0)
Pb	BDL	BDL	0.53 (<1.2-2.54)	BDL
Mg	575.5 (421.0-730.0)	6023 (1580-9680)	3053 (1030-9020)	2642 (1400-6000)
Mn	6.46 (5.61-7.31)	20.1 (10.7-28.4)	31.1 (10.2-55.5)	32.4 (15.1-44.2)
Mo	BDL	BDL	BDL	0.174 (<0.8-0.87)
Ni	BDL	0.85 (<0.8-2.56)	1.90 (<0.8-7.47)	2.47 (<0.8-4.24)
Ag ⁶	BDL	BDL	BDL	BDL
Sr	20.4 (5.13-35.7)	239.3 (101.0-328)	126.7 (22.9-308.0)	112.6 (14.6-365.0)
Sn	BDL	4.46 (<5.0-7.77)	4.86 (<5.0-23./9	1.07 (<5.0-5.36)

Table 5. Summary of elemental residues in fish tissues from the Caernarvon Freshwater (cont.) Diversion monitoring sites for 1990 [values are the mean and range (in parentheses) expressed in mg/kg, dry weight].

PARAMETER	SAMPLING LOCATIONS			
	MISS. RIVER ¹	BIG MAR ²	GRAND LAKE ³	BAY GARDENE ⁴
V	BDL ⁵	BDL	0.434 (<0.5-1.10)	0.649 (<0.5-1.23)
Zn	33.2 (24.0-42.3)	52.3 (50.1-56.2)	1741.4 (30.1-4760)	1238.1 (37.3-2050)
As	0.391 (0.371-0.410)	0.86 (<0.3-1.75)	2.79 (0.653-6.26)	3.35 (1.17-4.66)
Hg	0.406(0.025-0.788)	0.311(0.135-0.497)	0.299(0.148-0.496)	0.217(0.065-0.678)
Se	0.760 (0.459-1.06)	0.593(0.478-0.717)	1.378 (0.603-2.39)	2.07 (0.358-2.82)

¹Values for the Mississippi River are calculated on the basis of one specimen of channel catfish and one specimen of blue catfish.

²Values for Big Mar are calculated on the basis of three specimens: two spotted gar and one largemouth bass.

³Values for Grand Lake are calculated on the basis of seven specimens: three oysters, two red drum, a spotted gar, and an alligator gar.

⁴Values for Bay Gardene are calculated on the basis of five specimens: three oysters, a red drum, a spotted gar, and an alligator gar.

⁵BDL= Below detectable limit.

⁶The recovery of silver by ICP was usually low, thus little confidence can be placed in these results.

Table 6. Summary of elemental residues in tissue samples from the Caernarvon Freshwater Diversion monitoring sites for 1991 [values are the mean and range (in parentheses) expressed in mg/kg, dry weight].

PARAMETER	SAMPLING LOCATIONS			
	MISS. RIVER ¹	BIG MAR ²	GRAND LAKE ³	BAY GARDENE ⁴
Al ⁶	1.72 (<5.0-10.3)	64.8 (<5.0-182.0)	60.8 (<5.0-218.0)	116.7 (<5.0-262.0)
Sb		N O D A T A		
Ba	6.94 (1.75-10.9)	15.01 (7.81-27.3)	27.5 (3.82-133.0)	25.3 (15.1-37.1)
Be	BDL ⁵	BDL	0.01 (<0.1-0.206)	0.25 (<0.1-1.48)
B	BDL	4.84 (<1.5-5.72)	3.35 (<1.5-9.07)	6.30 (<1.5-11.3)
Cd	0.02 (<0.1-0.132)	BDL	0.03 (<0.1-2.44)	4.63 (<0.1-9.51)
Co		N O D A T A		
Cr	2.47 (0.502-92.3)	29.2 (4.39-95.7)	18.3 (0.684-64.0)	3.16 (0.786-6.22)
Cu	12.8 (1.11-26.3)	6.12 (1.58-11.8)	20.4 (<0.5-108.0)	135.7 (2.96-295.0)
Fe	192.5 (29.9-640.0)	237.7 (50.1-633.0)	203.9 (<1.5-296.0)	280.5 (<1.5-36.6)
Pb	1.35 (<1.5-3.09)	4.52 (<1.5-10.9)	23.4 (<1.5-296.0)	12.1 (<1.5-36.6)
Mg	142.3 (768-1710)	3936 (1340-8550)	3619 (1530-9820)	2143 (1640-2750)
Mn	11.5 (5.45-18.7)	25.2 (12.1-38.9)	42.1 (9.12-169.0)	34.3 (21.5-43.6)
Mo	BDL	BDL	BDL	0.25 (<0.8-1.49)
Ni	5.12 (<0.8-21.0)	6.21 (1.06-20.6)	3.90 (<0.8-13.4)	2.97 (1.0-7.41)
Ag		N O D A T A		
Sr	102.1 (33.3-214.0)	293.7 (211-404)	289.4 (9.67-455)	125.5 (22.7-298.0)
Sn		N O D A T A		

Table 6. Summary of elemental residues in fish tissues from the Caernarvon Freshwater (cont.) Diversion monitoring sites for 1991 [values are the mean and range (in parentheses) expressed in mg/kg, dry weight].

PARA-METER	SAMPLING LOCATIONS			
	MISS. RIVER ¹	BIG MAR ²	GRAND LAKE ³	BAY GARDENE ⁴
V	0.535 (<0.5-1.23)	BDL ⁵	0.282 (<0.5-0.879)	0.674 (<0.5-1.53)
Zn	70.7 (40.0-115.0)	71.9 (7.1-76.3)	291.5 (38.7-1980)	1299.0 (72.7-2720)
As	0.401 (<0.3-0.899)	0.96 (<0.3-1.62)	1.33 (0.330-4.08)	3.23 (0.716-5.69)
Hg	0.151 (<0.05-0.322)	0.104 (<0.05-0.314)	0.0786(<0.05-0.320)	0.157(0.052-0.314)
Se	1.83 (0.335-3.47)	0.960 (0.379-1.92)	0.856 (<0.03-1.92)	2.60 (1.84-3.35)

¹Values for the Mississippi River are calculated on the basis of one specimen of channel catfish and one specimen of blue catfish.

²Values for Big Mar are calculated on the basis of three specimens: two spotted gar and one largemouth bass.

³Values for Grand Lake are calculated on the basis of seven specimens: three oysters, two red drum, a spotted gar, and an alligator gar.

⁴Values for Bay Gardene are calculated on the basis of five specimens: three oysters, a red drum, a spotted gar, and an alligator gar.

⁵BDL= Below detectable limit.

⁶Due to the recent high laboratory variability in aluminum analyses, little confidence can be placed in these results.

APPENDIX A

I. Methodology for analyses of organochlorine pesticides and PCB's in animal tissues.

Ten gram tissue samples are thoroughly mixed with anhydrous sodium sulfate and soxhlet extracted with hexane for seven hours. The extract is concentrated by rotary evaporation, transferred to a tared test tube, and further concentrated to dryness for lipid determination. The weighed lipid sample is dissolved in petroleum ether and extracted four times with acetonitrile saturated with petroleum ether. Residues are partitioned into petroleum ether which is washed, concentrated, and transferred to a glass chromatographic column containing 20 grams of Florisil. The column is eluted with 200 ml 6% diethyl ether/94% petroleum ether (Fraction I) followed by 200 ml 15% diethyl ether/85% petroleum ether (Fraction II). Fraction II is concentrated to appropriate volume for quantification of residues by packed or capillary column electron capture gas chromatography. Fraction I is concentrated and transferred to a silicic acid chromatographic column for additional cleanup required for separation of PCBs from other organochlorines. Three fractions are eluted from the silicic acid column. Each is concentrated to appropriate volume for quantification of residues by packed or megabore column, electron capture gas chromatography. PCBs are found in Fraction II.

II. Methodology for analyses of aliphatic hydrocarbons in animal tissues.

A sample of appropriate size (i.e. 15 grams animal tissue, 2 grams adipose, etc.) is digested in 6N aqueous potassium hydroxide for 24 hours at 35°C. The digestate is thoroughly cooled in an ice bath and carefully neutralized with glacial acetic acid. The neutralized reaction mixture is extracted three times with methylene chloride; the combined extracts are concentrated to near dryness and reconstituted in petroleum ether for transfer to a 20 gram 1% deactivated silica gel column, topped with 5 grams neutral alumina. Aliphatic and polynuclear aromatic hydrocarbon residues are separated by eluting aliphatics from the column with 100 ml petroleum ether (Fraction I) followed by elution of aromatics using, first, 100 ml of 40% methylene chloride/60% petroleum ether, then 50 ml methylene chloride (Combined eluates, Fraction II). If needed, Fraction I containing aliphatics is subjected to additional cleanup by concentration and transferred to a deactivated (2% water) Florisil column. Aliphatic residues are eluted from the Florisil column using 200 ml 6% diethyl ether/94% petroleum ether. The eluate is concentrated to appropriate volume for quantification by capillary column, flame ionization gas chromatography. The silica gel Fraction II containing aromatic hydrocarbons is

concentrated, reconstituted in methylene chloride, and subjected to a gel permeation chromatography (GPC) cleanup prior to quantification by capillary, flame ionization gas chromatography and fluorescence HPLC.

III. Elution profiles for Florisil, silica gel, and silicic acid column separations.

A. Florisil Column:

1. Fraction I (6% ethyl ether containing 2% ethanol, 94% petroleum ether) HCB, α -BHC, β -BHC, γ -BHC, δ -BHC, oxychlordane, heptachlor epoxide, γ -chlordane, τ -nonachlor, toxaphene, PCBs, o,p'-DDE, α -chlordane, p,p'-DDE, o,p'-DDD, cis-nonachlor, o,p'-DDT, p,p'-DDD, p,p'-DDT, and mirex.
2. Fraction II (15% ethyl ether containing 2% ethanol, 85% petroleum ether) Dieldrin and endrin.

B. Florisil Mini-Column:

1. Fraction I (12ml hexane followed by 12ml 1% methanol in hexane) HCB, α -BHC (splits with Fraction II), γ -BHC (25%), τ -nonachlor, o,p'-DDE, p,p'-DDE, o,p'-DDD, o,p'-DDT, p,p'-DDD, p,p'-DDT, mirex, cis-nonachlor, and PCBs.
2. Fraction II (24ml 1% methanol in hexane) α -BHC(splits with Fraction I), β -BHC, γ -BHC (75%), δ -BHC, oxychlordane, heptachlor epoxide, and toxaphene.

C. Silica Gel:

1. SG Fraction I (100ml petroleum ether) η -dodecane, η -tridecane, η -tetradecane, ocylohexane, η -pentadecane, nonycyclohexane, η -hexadecane, η -heptadecane, pristane, η -octadecane, phytane, η -nonadecane, and η -eicosane.

D. Silicic Acid:

1. SA Fraction I (20ml petroleum ether) HCB and mirex.
2. SA Fraction II (100ml petroleum ether) PCBs and p,p'-DDE (splits with SA Fraction III)
3. SA Fraction III (20ml mixed solvent: 1% acetonitrile, 80% methylene chloride, and 19% hexane) α -BHC, β -BHC, γ -BHC, δ -BHC, oxychlordane, heptachlor epoxide, γ -chlordane, toxaphene, o,p'-DDE, α -chlordane, p,p'-DDE, o,p'-DDD, cis-nonachlor, o,p'-DDT, p,p'-DDD, and p,p'-DDT.

IV. Methodology for analyses of inorganics in animal tissues.

A. Tissue sample preparation

1. Homogenization. These are performed using a Kitchen Aid food processor. Portions are then freeze dried for determination of moisture content and subsequent acid digestion.
2. Preconcentration Digestion for Inductively Coupled Plasma Emission (ICP) Measurements. Using a CEM microwave oven, 0.5g of freeze dried tissue are heated in a capped 120 ml Teflon vessel in the presence of 5ml of Baker Instra-Analyzed nitric acid for three minutes at 120 watts, three minutes at 300 watts, and 35 minutes at 450 watts. The vessel contents are then allowed to cool and the cap is removed and rinsed carefully with 3ml of HNO_3 adding the rinsing with the vessel's contents. The uncapped vessel is then returned to the microwave oven and heated until the contents are less than 1ml in volume. The contents are carefully rinsed with laboratory pure water into a 10ml glass volumetric vessel and made to volume with additional laboratory pure water. The flask contents are then immediately transferred to a clean plastic centrifuge or auto sampler tube and centrifuged for 1 minute to precipitate the suspended matter. The sample is then ready for ICP analysis.
3. Digestion for ICP Measurement. Using a CEM microwave oven, 0.25 to 0.5g of freeze dried tissue are heated in a capped 120ml Teflon vessel in the presence of 5ml of Baker Instra-Analyzed nitric acid for three minutes at 120 watts, three minutes at 300 watts, and 15 minutes at 450 watts. The residue is then diluted to 50ml with 5% HCl.
4. Digestion for Graphite Furnace Atomic Absorption (GFAA)m Measurement. Using a CEM microwave oven, 0.25 to 0.5g of freeze dried tissue are heated in a capped 120ml Teflon vessel in the presence of 5ml of Baker Instra-Analyzed nitric acid for three minutes at 120 watts, three minutes at 300 watts, and 15 minutes at 450 watts. The residue is then diluted to 50ml with laboratory pure water.
5. Digestion for Mercury Measurement by Cold Vapor Atomic Absorption (CVAA). 0.25 to 0.5g of tissue are refluxed for two hours in 10ml Baker Instra-Analyzed nitric acid and diluted to 50ml with 1% HCl.

B. MEASUREMENT

1. ICP. ICP measurements were made using a Leeman Labs Plasma Spec I sequential spectrometer.

2. GFAA. GFAA measurements were made using a Perkin Elmer Zeeman 3030 atomic absorption spectrophotometer with an HGA-600 graphite furnace and an AS-60 autosampler.
3. CVAA. Mercury measurements were conducted using SnCl_4 as the reducing agent. An Instrumentation Laboratories Model 251 AA spectrophotometer was employed.

Table A1. Minimum detection limits(MDL) for the organochlorine and aliphatic hydrocarbon tissue residue analyses.

ORGANOCHLORINES		ALIPHATIC HYDROCARBONS	
PARAMETER	MDL	PARAMETER	MDL
HCB	0.01	η -DODECANE	0.01
α -BHC	0.01	η -TRIDECANE	0.01
γ -BHC	0.01	η -TETRADECANE	0.01
β -BHC	0.01	OCTYLCYCLOHEXANE	0.01
δ -BHC	0.01	η -PENTADECANE	0.01
OXYCHLORDANE	0.01	NONYLCYCLOHEXANE	0.01
HEPTACHLOR EPOXIDE	0.01	η -HEXADECANE	0.01
γ -CHLORDANE	0.01	η -HEPTADECANE	0.01
τ -NONACHLOR	0.01	PRISTANE	0.01
TOXAPHENE	0.05	η -OCTADECANE	0.01
PCB's	0.05	PHYTANE	0.01
<i>o,p'</i> -DDE	0.01	η -NONADECANE	0.01
γ -CHLORDANE	0.01	η -EICOSANE	0.01
<i>p,p'</i> -DDE	0.01		
DIELDRIN	0.01		
<i>o,p'</i> -DDD	0.01		
ENDRIN	0.01		
<i>cis</i> -NONACHLOR	0.01		
<i>o,p'</i> -DDT	0.01		
<i>p,p'</i> -DDD	0.01		
<i>p,p'</i> -DDT	0.01		
MIREX	0.01		

Table A2. Minimum detection limits (MDL) for the inorganic tissue residue analyses.

HEAVY METALS		
PARAMETER	MDL(1990)	MDL(1991)
ALUMINUM	2.0	5.0
ANTIMONY	5.0	NA
BARIUM	0.5	0.5
BERYLLIUM	0.05	0.1
BORON	0.8	1.5
CADMIUM	0.15	0.10
COBALT	0.5	NA
CHROMIUM	0.5	0.5
COPPER	0.5	0.5
IRON	10.0	10.0
LEAD	1.2	1.5
MAGNESIUM	20.0	10.0
MANGANESE	0.3	0.5
MOLYBDENUM	0.3	0.8
NICKEL	0.8	0.8
SILVER	2.0	NA
STRONTIUM	0.5	0.5
TIN	5.0	NA
VANADIUM	0.5	0.5
ZINC	1.0	1.0
ARSENIC	0.3	0.3
MERCURY	0.02	0.1
SELENIUM	0.3	0.3

APPENDIX B

RESIDUES IN TISSUE SAMPLES FROM THE CAERNARVON
FRESHWATER DIVERSION MONITORING SITES FOR 1990 AND 1991.

Table B1. Organochlorine residues in tissue samples from the Caernarvon Freshwater Diversion monitoring sites for 1990 (values expressed in mg/kg, wet weight).

SITE	SPECIES	PARAMETER/CONTAMINANT							
		WT. (g)	%H ₂ O	%LIPID	HCB	α -BHC	γ -BHC	β -BHC	δ -BHC
1	CHANNEL CATFISH	444.0	61.2	24.5	0.03	ND	ND	ND	ND
	BLUE CATFISH	4160.0	70.0	1.05	0.02	ND	ND	ND	ND
2	SPOTTED GAR	1900.0	65.4	5.92	ND	ND	ND	ND	ND
	LARGEMOUTH BASS	202.0	76.6	2.42	ND	ND	ND	ND	ND
	SPOTTED GAR	1710.0	66.6	4.36	ND	ND	ND	ND	ND
3	AMERICAN OYSTER	123.0	91.0	0.62	ND	ND	ND	ND	ND
	AMERICAN OYSTER	99.4	90.0	0.78	ND	ND	ND	ND	ND
	AMERICAN OYSTER	134.0	92.0	0.52	ND	ND	ND	ND	ND
	SPOTTED GAR	2070.0	67.5	3.44	ND	ND	ND	ND	ND
	ALLIGATOR GAR	6200.0	73.5	3.88	ND	ND	ND	ND	ND
	RED DRUM	4830.0	78.5	1.54	ND	ND	ND	ND	ND
	RED DRUM	5550.0	75.0	3.16	ND	ND	ND	ND	ND
4	AMERICAN OYSTER	266.0	85.0	1.52	ND	ND	ND	ND	ND
	AMERICAN OYSTER	244.0	85.5	2.00	ND	ND	ND	ND	ND
	AMERICAN OYSTER	276.0	84.0	1.80	ND	ND	ND	ND	ND
	ALLIGATOR GAR	5750.0	74.0	2.30	ND	ND	ND	ND	ND
	RED DRUM	6170.0	76.0	2.68	ND	ND	ND	ND	ND

Table B1. Organochlorine residues in tissue samples from the Caernarvon Freshwater (cont.) Diversion monitoring sites for 1990 (values expressed in mg/kg, wet weight).

SITE	SPECIES	PARAMETER/CONTAMINANT							
		OXYCHL ORDANE	HEPT. EPOX.	γ -CHLOR DANE	τ -NON ACHLOR	TOXA- PHENE	PCB's	o,p'- -DDE	α -CHLOR DANE
1	CHANNEL CATFISH	ND	ND	0.03	0.02	ND	ND	ND	0.05
	BLUE CATFISH	ND	ND	0.05	0.05	ND	ND	ND	0.06
2	SPOTTED GAR	ND	ND	ND	ND	ND	ND	ND	ND
	LARGEMOUTH BASS	ND	ND	ND	ND	ND	ND	ND	ND
	SPOTTED GAR	ND	ND	ND	ND	ND	ND	ND	ND
3	AMERICAN OYSTER	ND	ND	ND	ND	ND	ND	ND	ND
	AMERICAN OYSTER	ND	ND	ND	ND	ND	ND	ND	ND
	AMERICAN OYSTER	ND	ND	ND	ND	ND	ND	ND	ND
	SPOTTED GAR	ND	ND	ND	ND	ND	ND	ND	ND
	ALLIGATOR GAR	ND	ND	ND	ND	ND	ND	ND	ND
	RED DRUM	ND	ND	ND	ND	ND	ND	ND	ND
	RED DRUM	ND	ND	ND	ND	ND	ND	ND	ND
4	AMERICAN OYSTER	ND	ND	ND	ND	ND	ND	ND	ND
	AMERICAN OYSTER	ND	ND	ND	ND	ND	ND	ND	ND
	AMERICAN OYSTER	ND	ND	ND	ND	ND	ND	ND	ND
	ALLIGATOR GAR	ND	ND	ND	ND	ND	ND	ND	ND
	RED DRUM	ND	ND	ND	ND	ND	ND	ND	ND

Table B1. Organochlorine residues in tissue samples from the Caernarvon Freshwater (cont.) Diversion monitoring sites for 1990 (values expressed in mg/kg, wet weight).

PARAMETER/CONTAMINANT										
SITE	SPECIES	p,p'-DDE	DEL DRIN	o,p'-DDD	ENDRIN	cis-NON ACHLOR	o,p'-DDT	p,p'-DDD	p,p'-DDT	MIREX
1	CHANNEL CATFISH	0.07	0.09	ND	ND	ND	ND	0.10	0.07	ND
	BLUE CATFISH	0.10	0.05	ND	ND	ND	ND	0.10	0.05	ND
2	SPOTTED GAR	0.02	ND	ND	ND	ND	ND	ND	ND	ND
	LARGEMOUTH BASS	0.01	ND	ND	ND	ND	ND	ND	ND	ND
	SPOTTED GAR	0.01	ND	ND	ND	ND	ND	ND	ND	ND
3	AMERICAN OYSTER	ND	ND	ND	ND	ND	ND	ND	ND	ND
	AMERICAN OYSTER	ND	ND	ND	ND	ND	ND	ND	ND	ND
	AMERICAN OYSTER	ND	ND	ND	ND	ND	ND	ND	ND	ND
	SPOTTED GAR	0.01	ND	ND	ND	ND	ND	ND	ND	ND
	ALLIGATOR GAR	0.02	ND	ND	ND	ND	ND	ND	ND	ND
	RED DRUM	0.02	ND	ND	ND	ND	ND	ND	ND	ND
	RED DRUM	ND	ND	ND	ND	ND	ND	ND	ND	ND
4	AMERICAN OYSTER	ND	ND	ND	ND	ND	ND	ND	ND	ND
	AMERICAN OYSTER	ND	ND	ND	ND	ND	ND	ND	ND	ND
	AMERICAN OYSTER	ND	ND	ND	ND	ND	ND	ND	ND	ND
	ALLIGATOR GAR	0.01	ND	ND	ND	ND	ND	ND	ND	ND
	RED DRUM	0.02	ND	ND	ND	ND	ND	ND	ND	ND

Table B2. Organochlorine residues in tissue samples from the Caernarvon Freshwater Diversion monitoring sites for 1991 (values expressed in mg/kg, wet weight).

SITE	SPECIES	PARAMETER/CONTAMINANT							
		WT. (g)	%H2O	%LIPID	HCB	α -BHC	γ -BHC	β -BHC	δ -BHC
1	STRIPED BASS	487	73.2	3.73	ND	ND	ND	ND	ND
	STRIPED BASS	426	76.2	3.13	ND	ND	ND	ND	ND
	STRIPED BASS	478	74.0	3.95	ND	ND	ND	ND	ND
	CHANNEL CATFISH	639	77.0	5.51	ND	ND	ND	ND	ND
	CHANNEL CATFISH	496	61.6	26.8	0.01	ND	ND	ND	ND
	CHANNEL CATFISH	858	73.0	6.83	ND	ND	ND	ND	ND
2	LARGEMOUTH BASS	254	72.2	5.55	ND	ND	ND	ND	ND
	LARGEMOUTH BASS	315	75.2	2.12	ND	ND	ND	ND	ND
	LARGEMOUTH BASS	121	73.4	1.23	ND	ND	ND	ND	ND
	SPOTTED GAR	688	67.0	4.69	ND	ND	ND	ND	ND
	SPOTTED GAR	587	68.4	6.08	ND	ND	ND	ND	ND
	SPOTTED GAR	657	64.2	6.99	ND	ND	ND	ND	ND
	BLACK DRUM	533	74.4	5.66	ND	ND	ND	ND	ND
	BLACK DRUM	435	74.0	5.21	ND	ND	ND	ND	ND
	BLACK DRUM	592	73.8	5.74	ND	ND	ND	ND	ND
3	ALLIGATOR GAR	3057	66.6	5.11	ND	ND	ND	ND	ND
	ALLIGATOR GAR	1449	72.6	2.56	ND	ND	ND	ND	ND
	ALLIGATOR GAR	2527	71.8	1.86	ND	ND	ND	ND	ND

Table B2. Organochlorine residues in tissue samples from the Caernarvon Freshwater
(cont.) Diversion monitoring sites for 1991 (values expressed in mg/kg, wet weight).

SITE	SPECIES	PARAMETER/CONTAMINANT							
		OXYCHL ORDANE	HEPT. EPOX.	γ -CHLOR DANE	τ -NON- ACHLOR	TOXA- PHENE	PCB's	o,p'- -DDE	α -CHLOR DANE
1	STRIPED BASS	ND	ND	ND	0.01	ND	0.32	ND	0.01
	STRIPED BASS	ND	ND	ND	ND	ND	0.17	ND	ND
	STRIPED BASS	ND	ND	ND	0.02	ND	0.42	ND	0.02
	CHANNEL CATFISH	ND	0.01	0.01	0.02	ND	0.25	ND	0.02
	CHANNEL CATFISH	ND	0.03	0.02	0.02	ND	0.35	ND	0.03
	CHANNEL CATFISH	ND	0.01	0.01	ND	ND	0.25	ND	0.02
2	LARGEMOUTH BASS	ND	ND	ND	ND	ND	ND	ND	ND
	LARGEMOUTH BASS	ND	ND	ND	ND	ND	ND	ND	ND
	LARGEMOUTH BASS	ND	ND	ND	ND	ND	ND	ND	ND
	SPOTTED GAR	ND	ND	ND	ND	ND	ND	ND	ND
	SPOTTED GAR	ND	ND	ND	ND	ND	ND	ND	ND
	SPOTTED GAR	ND	ND	ND	ND	ND	ND	ND	ND
	BLACK DRUM	ND	ND	ND	ND	ND	ND	ND	ND
	BLACK DRUM	ND	ND	ND	ND	ND	ND	ND	ND
	BLACK DRUM	ND	ND	ND	ND	ND	ND	ND	ND
3	ALLIGATOR GAR	ND	ND	ND	ND	ND	ND	ND	ND
	ALLIGATOR GAR	ND	ND	ND	ND	ND	ND	ND	ND
	ALLIGATOR GAR	ND	ND	ND	ND	ND	ND	ND	ND

Table B2. Organochlorine residues in tissue samples from the Caernarvon Freshwater (cont.) Diversion monitoring sites for 1991 (values expressed in mg/kg, wet weight).

SITE	SPECIES	PARAMETER/CONTAMINANT								
		p,p'-DDE	DIEL DRIN	o,p'-DDD	ENDRIN	cis-NON-ACHLOR	o,p'-DDT	p,p'-DDD	p,p'-DDT	MIREX
1	STRIPED BASS	0.04	0.02	ND	ND	ND	ND	0.02	ND	ND
	STRIPED BASS	0.02	ND	ND	ND	ND	ND	0.01	ND	ND
	STRIPED BASS	0.06	0.03	ND	ND	ND	ND	0.04	ND	ND
	CHANNEL CATFISH	0.03	0.02	ND	ND	ND	ND	0.02	ND	ND
	CHANNEL CATFISH	0.06	0.09	ND	ND	ND	ND	0.04	ND	ND
	CHANNEL CATFISH	0.03	0.03	ND	ND	ND	ND	0.03	ND	ND
2	LARGEMOUTH BASS	0.01	ND	ND	ND	ND	ND	ND	ND	ND
	LARGEMOUTH BASS	0.01	ND	ND	ND	ND	ND	0.01	ND	ND
	LARGEMOUTH BASS	0.01	ND	ND	ND	ND	ND	ND	ND	ND
	SPOTTED GAR	ND	ND	ND	ND	ND	ND	ND	ND	ND
	SPOTTED GAR	0.02	ND	ND	ND	ND	ND	ND	ND	ND
	SPOTTED GAR	0.01	ND	ND	ND	ND	ND	ND	ND	ND
	BLACK DRUM	ND	ND	ND	ND	ND	ND	ND	ND	ND
	BLACK DRUM	ND	ND	ND	ND	ND	ND	ND	ND	ND
	BLACK DRUM	ND	ND	ND	ND	ND	ND	ND	ND	ND
3	ALLIGATOR GAR	0.02	ND	ND	ND	ND	ND	ND	ND	ND
	ALLIGATOR GAR	0.01	ND	ND	ND	ND	ND	ND	ND	ND
	ALLIGATOR GAR	0.01	ND	ND	ND	ND	ND	ND	ND	ND

Table B2. Organochlorine residues in tissue samples from the Caernarvon Freshwater
(cont.) Diversion monitoring sites for 1991 (values expressed in mg/kg, wet weight).

PARAMETER/CONTAMINANT									
SITE	SPECIES	WT. (g)	%H2O	%LIPID	HCB	α -BHC	γ -BHC	β -BHC	δ -BHC
3	LARGEMOUTH BASS	423	71.4	6.30	ND	ND	ND	ND	ND
	LARGEMOUTH BASS	388	74.2	4.35	ND	ND	ND	ND	ND
	LARGEMOUTH BASS	433	71.0	6.38	ND	ND	ND	ND	ND
	REDEAR	322	72.2	5.22	ND	ND	ND	ND	ND
	REDEAR	220	72.2	3.18	ND	ND	ND	ND	ND
	REDEAR	204	72.4	3.47	ND	ND	ND	ND	ND
	SHEEPSHEAD	1093	68.2	9.47	ND	ND	ND	ND	ND
	SHEEPSHEAD	909	69.4	5.99	ND	ND	ND	ND	ND
	SHEEPSHEAD	539	67.8	5.43	ND	ND	ND	ND	ND
	SPOTTED GAR	1279	62.8	4.33	ND	ND	ND	ND	ND
	SPOTTED GAR	1162	61.0	9.14	ND	ND	ND	ND	ND
	SPOTTED GAR	951	55.0	5.36	ND	ND	ND	ND	ND
	AMERICAN OYSTER	190	61.0	1.65	ND	ND	ND	ND	ND
	AMERICAN OYSTER	147	86.2	1.49	ND	ND	ND	ND	ND
	AMERICAN OYSTER	190	85.8	1.48	ND	ND	ND	ND	ND
4	RED DRUM	3357	74.2	4.16	ND	ND	ND	ND	ND
	RED DRUM	1480	75.4	0.95	ND	ND	ND	ND	ND
	RED DRUM	1917	71.4	3.40	ND	ND	ND	ND	ND
	AMERICAN OYSTER	82	88.0	1.35	ND	ND	ND	ND	ND
	AMERICAN OYSTER	100	86.0	1.50	ND	ND	ND	ND	ND
	AMERICAN OYSTER	101	86.5	1.27	ND	ND	ND	ND	ND

Table B2. Organochlorine residues in tissue samples from the Caernarvon Freshwater (cont.) Diversion monitoring sites for 1991 (values expressed in mg/kg, wet weight).

PARAMETER/CONTAMINANT									
SITE	SPECIES	OXYCHLO RDANE	HEPT. EPOX.	γ -CHLOR- DANE	τ -NON ACHLOR	TOXA- PHENE	PCB's	o,p'- DDE	α -CHLOR- DANE
3	LARGEMOUTH BASS	ND	ND	ND	ND	ND	ND	ND	ND
	LARGEMOUTH BASS	ND	ND	ND	ND	ND	ND	ND	ND
	LARGEMOUTH BASS	ND	ND	ND	ND	ND	ND	ND	ND
	REDEAR	ND	ND	ND	ND	ND	ND	ND	ND
	REDEAR	ND	ND	ND	ND	ND	ND	ND	ND
	REDEAR	ND	ND	ND	ND	ND	ND	ND	ND
	SHEEPSHEAD	ND	ND	ND	ND	ND	ND	ND	ND
	SHEEPSHEAD	ND	ND	ND	ND	ND	ND	ND	ND
	SHEEPSHEAD	ND	ND	ND	ND	ND	ND	ND	ND
	SPOTTED GAR	ND	ND	ND	ND	ND	ND	ND	ND
	SPOTTED GAR	ND	ND	ND	ND	ND	ND	ND	ND
	SPOTTED GAR	ND	ND	ND	ND	ND	ND	ND	ND
	AMERICAN OYSTER	ND	ND	ND	ND	ND	ND	ND	ND
	AMERICAN OYSTER	ND	ND	ND	ND	ND	ND	ND	ND
	AMERICAN OYSTER	ND	ND	ND	ND	ND	ND	ND	ND
4	RED DRUM	ND	ND	ND	ND	ND	ND	ND	ND
	RED DRUM	ND	ND	ND	ND	ND	ND	ND	ND
	RED DRUM	ND	ND	ND	ND	ND	ND	ND	ND
	AMERICAN OYSTER	ND	ND	ND	ND	ND	ND	ND	ND
	AMERICAN OYSTER	ND	ND	ND	ND	ND	ND	ND	ND
	AMERICAN OYSTER	ND	ND	ND	ND	ND	ND	ND	ND

Table B2. Organochlorine residues in tissue samples from the Caernarvon Freshwater (cont.) Diversion monitoring sites for 1991 (values expressed in mg/kg, wet weight).

[illegible]

Table B3. Aliphatic hydrocarbon residues in tissue samples from the Caernarvon Freshwater Diversion monitoring sites for 1990 (values expressed in mg/kg, wet weight).

SITE	SPECIES	PARAMETER/CONTAMINANT							
		WT. (g)	%H2O	%LIPID	η -DO DECANE	η -TRI DECANE	η -TETRA DECANE	OCTYLCYC LOHEXANE	η -PENTA DECANE
1	CHANNEL CATFISH	444.0	61.2	24.5	0.02	0.06	0.18	0.08	2.5
	BLUE CATFISH	4160.0	70.0	1.05	0.05	0.01	0.09	0.07	0.28
2	SPOTTED GAR	1900.0	65.4	5.92	ND	ND	0.01	ND	0.09
	LARGEMOUTH BASS	202.0	76.6	2.42	ND	ND	ND	ND	0.05
	SPOTTED GAR	1710.0	66.6	4.36	ND	ND	ND	ND	0.07
3	AMERICAN OYSTER	123.0	91.0	0.62	ND	ND	ND	ND	0.06
	AMERICAN OYSTER	99.4	90.0	0.78	ND	ND	ND	ND	0.02
	AMERICAN OYSTER	134.0	92.0	0.52	ND	ND	ND	ND	ND
	SPOTTED GAR	2070.0	67.5	3.44	ND	ND	ND	0.05	0.03
	ALLIGATOR GAR	6200.0	73.5	3.88	ND	ND	0.01	0.03	0.10
	RED DRUM	4830.0	78.5	1.54	ND	ND	0.01	0.03	0.09
	RED DRUM	5550.0	75.0	3.16	ND	ND	ND	ND	0.02
	RED DRUM	5550.0	75.0	3.16	ND	ND	ND	ND	0.02
4	AMERICAN OYSTER	266.0	85.0	1.52	ND	ND	0.01	ND	0.08
	AMERICAN OYSTER	244.0	85.5	2.00	ND	ND	ND	ND	0.09
	AMERICAN OYSTER	276.0	84.0	1.80	ND	ND	ND	ND	0.06
	ALLIGATOR GAR	5750.0	74.0	2.30	ND	ND	ND	ND	0.04
	RED DRUM	6170.0	76.0	2.68	ND	ND	0.01	ND	0.02

Table B3. Aliphatic hydrocarbon residue in tissue samples from the Caernarvon Freshwater (cont.) Diversion monitoring sites for 1990 (values expressed in mg/kg, wet weight).

PARAMETER/CONTAMINANT									
SITE	SPECIES	NONYLCYC LOHEXANE	η -HEXA DECANE	η -HEPTA DECANE	PRIS TANE	η -OCTA DECANE	PHY- TANE	η -NONA DECANE	η -EIC OSANE
1	CHANNEL CATFISH	0.19	0.58	6.5	1.3	0.62	0.26	0.25	0.13
	BLUE CATFISH	0.12	0.17	1.0	0.24	0.15	0.16	0.06	0.02
2	SPOTTED GAR	ND	0.01	0.18	ND	ND	0.01	0.04	ND
	LARGEMOUTH BASS	ND	0.01	0.06	0.02	0.01	0.03	0.04	ND
	SPOTTED GAR	ND	ND	0.18	0.01	ND	0.01	0.02	0.01
3	AMERICAN OYSTER	ND	0.01	0.18	0.08	ND	ND	0.02	ND
	AMERICAN OYSTER	ND	0.02	0.02	0.03	ND	0.03	ND	ND
	AMERICAN OYSTER	ND	ND	0.02	0.02	ND	0.01	ND	ND
	SPOTTED GAR	ND	0.01	0.25	0.02	0.01	0.02	ND	0.01
	ALLIGATOR GAR	0.01	0.02	0.29	0.14	0.01	0.01	0.02	0.01
	RED DRUM	ND	ND	0.04	0.06	0.01	ND	0.01	0.02
	RED DRUM	ND	0.01	0.07	0.08	ND	ND	ND	0.01
4	AMERICAN OYSTER	ND	0.01	0.05	ND	ND	0.02	ND	ND
	AMERICAN OYSTER	ND	0.02	0.06	ND	ND	ND	ND	ND
	AMERICAN OYSTER	ND	0.01	0.05	ND	ND	ND	ND	ND
	ALLIGATOR GAR	ND	ND	0.13	0.01	ND	0.01	0.02	ND
	RED DRUM	ND	ND	ND	0.04	0.02	ND	ND	ND

Table B4. Aliphatic hydrocarbon residues in tissue samples from the Caernarvon Freshwater Diversion monitoring sites for 1991 (values expressed in mg/kg, wet weight).

SITE	SPECIES	PARAMETER/CONTAMINANT							
		WT. (g)	%H2O	%LIPID	η -DO DECANE	η -TRI DECANE	η -TETRA DECANE	OCTYLCYC LOHEXANE	η -PENTA DECANE
1	STRIPED BASS	487	73.2	3.73	0.02	0.03	0.02	ND	0.15
	STRIPED BASS	426	76.2	3.13	0.02	0.04	0.04	ND	0.53
	STRIPED BASS	478	74.0	3.95	0.02	0.04	0.04	0.01	0.27
	CHANNEL CATFISH	639	77.0	5.51	0.05	0.06	0.12	0.05	0.29
	CHANNEL CATFISH	496	61.6	26.8	ND	ND	0.13	0.06	0.13
	CHANNEL CATFISH	858	73.0	6.83	ND	ND	0.13	0.06	0.13
2	LARGEMOUTH BASS	254	72.2	5.55	0.05	0.22	0.22	0.07	0.82
	LARGEMOUTH BASS	315	75.2	2.12	0.02	0.03	0.02	ND	0.03
	LARGEMOUTH BASS	121	73.4	1.23	0.03	0.03	0.03	ND	0.05
	SPOTTED GAR	688	67.0	4.69	0.01	0.02	0.03	ND	0.07
	SPOTTED GAR	587	68.4	6.08	0.03	0.04	0.04	ND	0.05
	SPOTTED GAR	657	64.2	6.99	0.03	0.03	0.04	ND	0.61
	BLACK DRUM	533	74.4	5.66	0.02	0.02	0.01	ND	0.07
	BLACK DRUM	435	74.0	5.21	0.03	0.04	0.03	0.02	0.16
	BLACK DRUM	592	73.8	5.74	ND	0.01	0.03	ND	0.14
3	ALLIGATOR GAR	3057	66.6	5.11	ND	0.01	0.03	ND	0.15
	ALLIGATOR GAR	1449	72.6	2.56	0.04	0.05	0.03	ND	0.19
	ALLIGATOR GAR	2527	71.8	1.86	0.01	0.03	0.03	ND	0.06

Table B4. Aliphatic hydrocarbon residues in tissue samples from the Caernarvon Freshwater (Cont.) Diversion monitoring sites for 1991 (values expressed in mg/kg, wet weight).

SITE	SPECIES	PARAMETER/CONTAMINANT							
		NONYLCYC LOHEXANE	η -HEXA DECANE	η -HEPTA DECANE	PRIS TANE	η -OCTA- DECANE	PHY- TANE	η -NONA DECANE	η -EIC- OSANE
1	STRIPED BASS	0.01	0.03	0.19	0.43	0.02	0.04	0.03	0.02
	STRIPED BASS	0.01	0.06	0.41	0.51	0.03	0.04	0.03	0.05
	STRIPED BASS	0.03	0.04	0.39	0.38	0.03	0.07	0.04	0.03
	CHANNEL CATFISH	0.09	0.32	1.3	0.24	0.27	0.22	0.18	0.13
	CHANNEL CATFISH	0.08	0.20	0.36	0.06	0.14	0.13	0.13	0.11
	CHANNEL CATFISH	0.16	0.71	1.4	0.51	0.52	0.38	0.34	0.22
2	LARGEMOUTH BASS	0.01	0.06	1.0	0.04	0.03	0.03	ND	0.02
	LARGEMOUTH BASS	ND	0.02	0.09	0.01	ND	0.04	0.12	0.02
	LARGEMOUTH BASS	ND	0.03	0.10	0.01	0.02	0.01	0.03	0.02
	SPOTTED GAR	ND	0.02	0.24	ND	0.01	0.01	ND	0.02
	SPOTTED GAR	ND	0.03	0.14	0.07	0.02	0.03	0.01	0.02
	SPOTTED GAR	ND	0.07	ND	ND	0.02	0.02	0.06	ND
	BLACK DRUM	ND	0.02	0.58	0.02	0.02	0.01	ND	0.07
	BLACK DRUM	0.03	0.04	0.13	0.02	0.02	0.13	0.03	ND
	BLACK DRUM	ND	0.02	0.22	0.07	0.02	0.09	0.04	0.03
3	ALLIGATOR GAR	ND	0.06	1.0	ND	0.03	0.01	0.04	ND
	ALLIGATOR GAR	0.02	0.02	0.03	ND	0.02	0.02	ND	0.02
	ALLIGATOR GAR	ND	0.02	0.66	ND	0.02	ND	0.04	0.01

Table B4. Aliphatic hydrocarbon residues in tissue samples from the Caernarvon Freshwater (cont.) Diversion monitoring sites for 1991 (values expressed in mg/kg, wet weight).

PARAMETER/CONTAMINANT									
SITE	SPECIES	WT. (g)	%H2O	%LIPID	η -DO- DECANE	η -TRI DECANE	η -TETRA DECANE	OCTYLCYC LOHEXANE	η -PENTA DECANE
3	LARGEMOUTH BASS	423	71.4	6.30	0.03	0.07	0.12	ND	0.22
	LARGEMOUTH BASS	388	74.2	4.35	0.03	0.05	0.03	ND	0.08
	LARGEMOUTH BASS	433	71.0	6.38	ND	0.05	0.04	ND	0.20
	REDEAR	322	72.2	5.22	0.03	0.07	0.04	0.01	0.06
	REDEAR	220	72.2	3.18	0.03	0.03	0.03	ND	0.05
	REDEAR	204	72.4	3.47	0.01	0.01	0.02	ND	0.04
	SHEEPSHEAD	1093	68.2	9.47	ND	0.01	0.02	ND	0.26
	SHEEPSHEAD	909	69.4	5.99	0.04	0.05	0.03	0.01	0.17
	SHEEPSHEAD	539	67.8	5.43	0.02	0.03	0.02	ND	0.06
	SPOTTED GAR	1279	62.8	4.33	ND	ND	ND	ND	0.02
	SPOTTED GAR	1162	61.0	9.14	0.03	0.04	0.03	ND	0.07
	SPOTTED GAR	951	55.0	5.36	0.03	0.05	0.03	0.02	0.07
	AMERICAN OYSTER	190	61.0	1.65	0.02	0.03	0.02	ND	0.03
	AMERICAN OYSTER	147	86.2	1.49	0.02	0.02	0.02	ND	0.03
	AMERICAN OYSTER	190	85.8	1.48	0.03	0.05	0.03	0.01	0.03
4	RED DRUM	3357	74.2	4.16	0.02	0.03	0.03	ND	0.06
	RED DRUM	1480	75.4	0.95	0.02	0.03	0.02	ND	0.04
	RED DRUM	1917	71.4	3.40	0.02	0.05	0.03	ND	0.05
	AMERICAN OYSTER	82	88.0	1.35	ND	ND	0.02	ND	0.04
	AMERICAN OYSTER	100	86.0	1.50	0.04	0.04	0.03	ND	0.01
	AMERICAN OYSTER	101	86.5	1.27	ND	ND	0.01	ND	0.04

Table B4. Aliphatic hydrocarbon residues in tissue samples from the Caernarvon Freshwater (cont.) Diversion monitoring sites for 1991 (values expressed in mg/kg, wet weight).

PARAMETER/CONTAMINANT									
SITE	SPECIES	NONYLCYC LOHEXANE	η -HEXA DECANE	η -HEPTA DECANE	PRIS TANE	η -OCTA DECANE	PHY- TANE	η -NONA DECANE	η -EIC OSANE
3	LARGEMOUTH BASS	0.20	0.14	0.82	0.85	0.23	0.70	0.15	0.16
	LARGEMOUTH BASS	ND	0.03	0.51	0.01	0.02	0.03	0.03	0.02
	LARGEMOUTH BASS	0.01	0.05	0.85	ND	0.03	0.07	ND	0.02
	REDEAR	0.01	0.04	0.24	0.03	0.03	0.13	0.11	0.04
	REDEAR	ND	0.02	0.09	0.12	0.01	0.14	ND	ND
	REDEAR	ND	0.02	0.10	0.05	0.01	0.22	0.12	0.02
	SHEEPSHEAD	ND	0.05	3.0	0.06	0.04	0.03	0.12	0.04
	SHEEPSHEAD	ND	0.03	2.9	0.02	0.02	0.01	0.02	0.03
	SHEEPSHEAD	ND	0.02	0.03	ND	0.01	ND	0.01	0.02
	SPOTTED GAR	ND	0.02	0.17	ND	0.02	0.01	0.01	0.02
	SPOTTED GAR	0.01	0.03	0.21	0.03	0.02	0.01	0.01	0.03
	SPOTTED GAR	0.03	0.03	0.19	0.14	0.04	0.05	ND	ND
	AMERICAN OYSTER	ND	0.02	0.04	0.01	0.01	ND	ND	0.02
	AMERICAN OYSTER	ND	0.03	0.04	0.01	0.01	0.05	ND	ND
	AMERICAN OYSTER	ND	0.03	0.04	0.01	0.01	ND	ND	0.02
4	RED DRUM	ND	0.03	0.06	0.05	ND	ND	0.01	0.03
	RED DRUM	ND	0.03	0.05	0.01	0.02	ND	ND	0.02
	RED DRUM	ND	0.02	0.03	0.08	0.01	ND	ND	0.02
	AMERICAN OYSTER	ND	0.03	0.05	0.01	ND	ND	0.02	0.04
	AMERICAN OYSTER	ND	0.04	0.04	0.01	0.01	ND	0.01	0.03
	AMERICAN OYSTER	ND	0.03	0.03	0.01	ND	ND	ND	0.03

Table B5. Elemental residues in tissue samples from the Caernarvon Freshwater Diversion monitoring sites for 1990 (values expressed in mg/kg, dry weight).

SITE	SPECIES	PARAMETER/CONTAMINANT								
		WT. (g)	%H2O	Al	Sb	Ba	Be	B	Cd	Co
1	CHANNEL CATFISH	444.0	62.3	38.5	<5.00	0.75	<0.05	<0.80	<0.15	<0.50
	BLUE CATFISH	4160.0	70.3	47.1	<5.00	4.28	<0.05	<0.80	<0.15	<0.50
2	SPOTTED GAR	1900.0	64.3	<2.0	<5.00	10.6	<0.05	3.21	<0.15	<0.50
	LARGEMOUTH BASS	202.0	76.3	155	<5.00	3.69	<0.05	<0.80	<0.15	<0.50
	SPOTTED GAR	1710.0	68.3	29.5	<5.00	8.24	<0.05	2.67	<0.15	<0.50
3	AMERICAN OYSTER	123.0	89.3	176	<0.50	29.1	<0.05	4.89	4.05	4.49
	AMERICAN OYSTER	99.4	89.5	311	<5.00	22.6	<0.05	4.44	3.87	0.54
	AMERICAN OYSTER	134.0	89.9	365	<5.0	23.4	<0.05	4.69	4.34	0.72
	SPOTTED GAR	2070.0	66.0	<2.0	<5.0	12.1	<0.05	4.13	<0.15	<0.50
	ALLIGATOR GAR	6200.0	69.6	<2.0	<5.0	8.13	<0.05	1.06	0.518	<0.50
	RED DRUM	4830.0	75.9	<2.0	<5.0	11.5	<0.05	<0.80	<0.15	<0.50
	RED DRUM	5550.0	76.0	<2.0	<5.0	11.6	<0.05	<0.80	<0.15	<0.50
4	AMERICAN OYSTER	266.0	84.0	212	<5.0	8.85	<0.05	8.56	5.13	0.514
	AMERICAN OYSTER	244.0	83.4	217	<5.0	8.64	<0.05	8.31	4.35	0.587
	AMERICAN OYSTER	276.0	84.5	201	5.30	8.99	<0.05	8.92	5.17	0.996
	ALLIGATOR GAR	5750.0	70.3	<2.0	<5.0	11.7	<0.05	2.47	<0.15	<0.50
	RED DRUM	6170.0	74.2	4.43	<5.0	16.4	<0.05	1.42	<0.15	<0.50

Table B5. Elemental residues in tissue samples from the Caernarvon Freshwater Diversion monitoring (cont.) sites for 1990 (values expressed in mg/kg, dry weight).

SITE	SPECIES	PARAMETER/CONTAMINANT							
		Cr	Cu	Fe	Pb	Mg	Mn	Mo	Ni
1	CHANNEL CATFISH	0.593	0.660	124.0	<1.20	421.0	5.61	<0.80	<0.80
	BLUE CATFISH	6.35	1.89	130.0	<1.20	730.0	7.31	<0.80	<0.80
2	SPOTTED GAR	1.74	2.05	120.0	<1.20	9680.0	28.4	<0.80	<0.80
	LARGEMOUTH BASS	2.06	7.18	72.0	<1.20	1580.0	10.7	<0.80	2.56
	SPOTTED GAR	1.90	3.63	120.0	<1.20	6800.0	21.3	<0.80	<0.80
3	AMERICAN OYSTER	1.71	177.0	434.0	<1.20	1880.0	52.5	<0.80	7.47
	AMERICAN OYSTER	2.12	197.0	387.0	<1.20	1710.0	55.5	<0.80	3.11
	AMERICAN OYSTER	1.42	217.0	449.0	1.20	1880.0	54.0	<0.80	2.72
	SPOTTED GAR	1.64	2.69	197.0	<1.20	9020.0	16.4	<0.80	<0.80
	ALLIGATOR GAR	1.44	4.24	116.0	2.54	4750.0	15.8	<0.80	<0.80
	RED DRUM	0.730	3.19	89.0	<1.20	1030.0	13.4	<0.80	<0.80
	RED DRUM	1.08	2.42	83.3	<1.20	1100.0	10.2	<0.80	<0.80
4	AMERICAN OYSTER	1.02	145.0	298.0	<1.20	2110.0	44.2	0.87	3.73
	AMERICAN OYSTER	1.15	157.0	307.0	<1.20	1800.0	43.6	<0.80	3.26
	AMERICAN OYSTER	1.74	161.0	314.0	<1.20	1900.0	41.3	<0.80	4.24
	ALLIGATOR GAR	1.45	2.48	92.1	<1.20	6000.0	15.1	<0.80	<0.80
	RED DRUM	2.15	2.26	116.0	<1.20	1400.0	17.8	<0.80	1.13

Table B5. Elemental residues in tissue samples from the Caernarvon Freshwater Diversion monitoring (cont.) sites for 1990 (values expressed in mg/kg, dry weight).

PARAMETER/CONTAMINANT									
SITE	SPECIES	Ag*	Sr	Sn	V	Zn	As	Hg	Se
1	CHANNEL CATFISH	<2.0	5.13	<5.0	<0.5	24.0	0.371	0.0247	0.459
	BLUE CATFISH	<2.0	35.7	<5.0	<0.5	42.3	0.410	0.788	1.06
2	SPOTTED GAR	<2.0	328.0	5.62	<0.5	50.1	0.830	0.135	0.478
	LARGEMOUTH BASS	<2.0	101.0	<5.0	<0.5	56.2	<0.300	0.497	0.717
	SPOTTED GAR	<2.0	289.0	7.77	<0.5	50.6	1.75	0.302	0.585
3	AMERICAN OYSTER	<2.0	22.9	<5.0	0.84	3430.0	3.48	0.178	1.65
	AMERICAN OYSTER	<2.0	46.9	<5.0	1.10	3790.0	3.54	0.284	1.49
	AMERICAN OYSTER	<2.0	26.0	<5.0	1.10	4760.0	3.67	0.463	1.04
	SPOTTED GAR	<2.0	308.0	23.9	<0.5	78.5	1.02	0.148	0.603
	ALLIGATOR GAR	<2.0	279.0	10.1	<0.5	67.9	6.26	0.258	0.925
	RED DRUM	<2.0	88.8	<5.0	<0.5	30.1	0.653	0.496	2.39
	RED DRUM	<2.0	115.0	<5.0	<0.5	33.3	0.914	0.267	1.55
4	AMERICAN OYSTER	<2.0	16.9	<5.0	1.23	2010.0	4.66	0.0731	2.59
	AMERICAN OYSTER	<2.0	14.6	<5.0	0.994	2030.0	4.63	0.0813	2.81
	AMERICAN OYSTER	<2.0	19.5	<5.0	1.02	2050.0	4.42	0.0649	2.82
	ALLIGATOR GAR	<2.0	365.0	<5.0	<0.5	63.0	1,86	0.190	0.358
	RED DRUM	<2.0	147.0	5.36	<0.5	37.3	1.17	0.678	1.78

* The recovery of silver by ICP was usually low, thus little confidence can be placed in these results.

Table B6. Elemental residues in tissue samples from the Caernarvon Freshwater Diversion monitoring sites for 1991 (values expressed in mg/kg, dry weight).

SITE	SPECIES	WT. (g)	%H2O	PARAMETER/CONTAMINANT						
				Al*	Sb	Ba	Be	B	Cd	Co
1	STRIPED BASS	487	73.2	<5.0		10.5	<0.10	<1.5	<0.10	
	STRIPED BASS	426	76.2	<5.0		10.9	<0.10	<1.5	<0.10	
	STRIPED BASS	478	74.0	<5.0	N	9.76	<0.10	<1.5	<0.10	N
	CHANNEL CATFISH	639	77.0	<5.0		4.85	<0.10	<1.5	<0.10	
	CHANNEL CATFISH	496	61.6	<5.0	O	1.75	<0.10	<1.5	<0.10	O
	CHANNEL CATFISH	858	73.0	10.3		3.86	<0.10	<1.5	0.132	
2	LARGEMOUTH BASS	254	72.0	<5.0		7.81	<0.10	<1.5	<0.10	
	LARGEMOUTH BASS	315	75.2	71.1		9.10	<0.10	<1.5	<0.10	
	LARGEMOUTH BASS	121	73.4	<5.0		12.1	<0.10	<1.5	<0.10	
	SPOTTED GAR	688	67.0	182	D	13.4	<0.10	3.69	<0.10	D
	SPOTTED GAR	587	68.4	144		8.78	<0.10	5.72	<0.10	
	SPOTTED GAR	657	64.2	135	A	11.8	<0.10	3.59	<0.10	A
	BLACK DRUM	533	74.4	11.6		27.3	<0.10	<1.5	<0.10	
	BLACK DRUM	435	74.0	29.2	T	22.1	<0.10	<1.5	<0.10	T
	BLACK DRUM	592	73.8	9.99		22.7	<0.10	3.54	<0.10	
3	ALLIGATOR GAR	3057	66.6	<5.0	A	12.1	<0.10	<1.5	<0.10	A
	ALLIGATOR GAR	1449	72.6	<5.0		17.0	<0.10	2.07	<0.10	
	ALLIGATOR GAR	2527	71.8	<5.0		10.2	<0.10	<1.5	<0.10	

*Due to the recent high laboratory variability in aluminum analyses, little confidence can be placed in these results.

Table B6. Elemental residues in tissue samples from the Caernarvon Freshwater Diversion monitoring (cont.) sites for 1991 (values expressed in mg/kg, dry weight).

SITE	SPECIES	PARAMETER/CONTAMINANT							
		Cr	Cu	Fe	Pb	Mg	Mn	Mo	Ni
1	STRIPED BASS	27.1	25.6	205	3.09	1710	11.5	<0.80	6.23
	STRIPED BASS	9.93	26.3	129	1.54	1690	10.5	<0.80	2.18
	STRIPED BASS	92.3	21.2	640	3.44	1690	18.7	<0.80	21.0
	CHANNEL CATFISH	14.1	1.59	63.5	<1.50	1300	11.0	<0.80	<0.80
	CHANNEL CATFISH	0.502	1.11	29.9	<1.50	768	5.45	<0.80	<0.80
	CHANNEL CATFISH	4.28	2.26	87.8	<1.50	1580	11.6	<0.80	1.31
2	LARGEMOUTH BASS	95.7	6.71	633	8.20	1790	25.9	<0.80	20.6
	LARGEMOUTH BASS	8.89	2.54	152	3.39	2010	12.1	<0.80	2.02
	LARGEMOUTH BASS	4.39	1.58	50.1	1.80	2290	13.3	<0.80	1.06
	SPOTTED GAR	21.8	11.5	224	7.16	8440	38.9	<0.80	4.39
	SPOTTED GAR	10.0	8.84	159	10.9	8280	27.6	<0.80	2.27
	SPOTTED GAR	66.8	11.8	454	7.45	8550	33.5	<0.80	14.9
	BLACK DRUM	36.4	4.21	246	1.77	1350	38.5	<0.80	7.36
	BLACK DRUM	7.48	3.56	104	<1.50	1340	16.4	<0.08	1.81
	BLACK DRUM	11.2	4.34	117	<1.50	1370	25.0	<0.80	1.47
3	ALLIGATOR GAR	14.3	2.26	121	1.93	4110	15.8	<0.80	2.58
	ALLIGATOR GAR	13.0	1.85	105	<1.50	7810	27.1	<0.80	2.11
	ALLIGATOR GAR	10.1	<0.50	31.6	<1.50	4130	12.0	<0.80	1.01

Table B6. Elemental residues in tissue samples from the Caernarvon Freshwater Diversion monitoring (cont.) sites for 1991 (values expressed in mg/kg, dry weight).

SITE	SPECIES	PARAMETER/CONTAMINANT							
		Ag	Sr	Sn	V	Zn	As	Hg	Se
1	STRIPED BASS		141		<0.50	71.1	0.759	0.322	2.63
	STRIPED BASS		214		<0.50	59.1	0.899	0.249	2.56
	STRIPED BASS	N	96.8	N	0.532	115	0.746	0.138	3.47
	CHANNEL CATFISH		67.4		0.715	64.7	<0.3	<0.05	0.996
	CHANNEL CATFISH	O	33.3	O	1.23	40.0	<0.3	<0.05	0.335
	CHANNEL CATFISH		60.2		0.735	74.5	<0.3	0.197	0.972
2	LARGEMOUTH BASS		246		<0.50	97.1	0.592	0.0884	0.779
	LARGEMOUTH BASS		211		<0.50	52.8	<0.3	0.0655	0.445
	LARGEMOUTH BASS	D	396	D	<0.50	68.3	<0.3	0.198	0.619
	SPOTTED GAR		404		<0.50	76.3	1.05	0.0933	0.621
	SPOTTED GAR	A	393	A	<0.50	76.3	1.56	0.180	0.379
	SPOTTED GAR		318		<0.50	69.5	1.31	0.314	0.596
	BLACK DRUM	T	221	T	<0.50	65.5	1.16	<0.05	1.36
	BLACK DRUM		214		<0.50	66.4	1.38	<0.05	1.92
	BLACK DRUM	A	240	A	<0.50	74.8	1.62	<0.05	1.92
3	ALLIGATOR GAR		223		<0.50	47.7	0.483	0.320	0.513
	ALLIGATOR GAR		561		<0.50	71.4	0.439	0.100	0.449
	ALLIGATOR GAR		217		<0.50	38.7	0.330	0.0553	<0.3

Table B6. Elemental residues in tissue samples from the Caernarvon Freshwater Diversion monitoring (cont.) sites for 1991 (values expressed in mg/kg, dry weight).

SITE	SPECIES	WT. (g)	PARAMETER/CONTAMINANT							
			%H2O	Al	Sb	Ba	Be	B	Cd	Co
3	LARGEMOUTH BASS	423	74.1	8.46		133	<0.10	<1.50	0.277	
	LARGEMOUTH BASS	388	74.2	<5.0		33.6	0.206	<1.50	<0.10	
	LARGEMOUTH BASS	433	71.0	<5.0	N	22.9	<0.10	<1.50	0.213	N
	REDEAR	322	72.2	<5.0		16.9	<0.10	2.10	<0.10	
	REDEAR	220	72.2	60.6	O	18.2	<0.10	2.02	<0.10	O
	REDEAR	204	72.4	27.7		16.0	<0.10	<1.5	<0.10	
	SHEEPSHEAD	1063	68.2	5.81		57.1	<0.10	3.01	<0.10	
	SHEEPSHEAD	909	69.4	51.1		44.7	<0.10	3.50	<0.10	
	SHEEPSHEAD	539	67.8	<5.0	D	37.6	<0.10	1.52	<0.10	D
	SPOTTED GAR	1279	62.8	76.8		8.07	<0.10	7.17	<0.10	
	SPOTTED GAR	1162	61.0	210	A	10.9	<0.10	6.58	<0.10	A
	SPOTTED GAR	951	55.0	73.8		8.63	<0.10	6.38	<0.10	
	AMERICAN OYSTER	190	61.0	184	T	20.7	<0.10	8.32	2.44	T
	AMERICAN OYSTER	147	86.2	178		3.82	<0.10	9.07	0.437	
	AMERICAN OYSTER	190	85.8	218	A	24.4	<0.10	8.60	2.02	A
4	RED DRUM	3357	74.2	5.56		34.2	<0.10	<1.5	<0.10	
	RED DRUM	1480	75.4	10.7		28.9	1.48	3.22	1.04	
	RED DRUM	1917	71.4	<5.0		37.1	<0.10	1.94	<0.10	

Table B6. Elemental residues in tissue samples from the Caernarvon Freshwater Diversion monitoring (cont.) sites for 1991 (values expressed in mg/kg, dry weight).

SITE	SPECIES	PARAMETER/CONTAMINANT							
		Cr	Cu	Fe	Pb	Mg	Mn	Mo	Ni
3	LARGEMOUTH BASS	6.43	2.07	93.2	296	1640	9.12	<0.80	1.15
	LARGEMOUTH BASS	3.15	2.28	63.1	6.40	1790	11.0	<0.80	<0.80
	LARGEMOUTH BASS	4.67	1.84	67.6	56.4	1530	10.0	<0.80	2.09
	REDEAR	35.2	3.04	270	2.91	1710	25.0	<0.80	6.68
	REDEAR	10.2	1.77	168	<1.50	1870	19.5	<0.80	2.68
	REDEAR	14.7	2.20	185	2.57	1920	23.4	<0.80	2.83
	SHEEPSHEAD	64.0	4.39	388	2.76	2320	169	<0.80	13.4
	SHEEPSHEAD	55.2	5.44	444	4.50	1900	133	<0.80	9.89
	SHEEPSHEAD	49.7	3.92	290	<1.50	1900	146	<0.80	10.8
	SPOTTED GAR	10.2	6.30	182	4.90	8800	29.7	<0.80	1.78
	SPOTTED GAR	19.9	12.0	163	5.67	7620	14.9	<0.80	2.95
	SPOTTED GAR	11.8	6.81	93.1	2.13	9820	29.9	<0.80	1.97
	AMERICAN OYSTER	2.73	127	351	13.0	2050	29.6	<0.80	3.65
	AMERICAN OYSTER	0.684	75.3	319	<1.50	2240	25.7	<0.80	1.17
	AMERICAN OYSTER	3.27	108	335	22.6	1990	27.9	<0.80	3.38
4	RED DRUM	6.22	3.06	109	36.6	1640	43.6	<0.80	1.00
	RED DRUM	4.55	3.97	85.9	<1.50	1770	25.7	1.49	7.41
	RED DRUM	5.48	2.96	75.9	35.8	1680	21.5	<0.80	1.26

Table B6. Elemental residues in tissue samples from the Caernarvon Freshwater Diversion monitoring (cont.) sites for 1991 (values expressed in mg/kg, dry weight).

PARAMETER/CONTAMINANT									
SITE	SPECIES	Ag	Sr	Sn	V	Zn	As	Hg	Se
3	LARGEMOUTH BASS		291		<0.50	237	0.756	<0.05	0.550
	LARGEMOUTH BASS		241		<0.50	111	0.721	0.147	0.632
	LARGEMOUTH BASS	N	242	N	<0.50	77.1	0.651	0.106	0.602
	REDEAR		387		<0.50	67.5	0.919	0.0770	0.815
	REDEAR	O	455	O	<0.50	73.7	1.16	<0.05	1.02
	REDEAR		448		0.603	81.4	1.42	0.0644	0.882
	SHEEPSHEAD		303		0.644	68.2	0.905	<0.05	0.706
	SHEEPSHEAD		315		0.532	67.9	1.37	0.0694	1.01
	SHEEPSHEAD	D	281	D	0.584	58.6	1.09	0.157	1.14
	SPOTTED GAR		401		0.879	71.2	0.998	<0.05	0.838
	SPOTTED GAR	A	381	A	<0.50	61.5	0.931	0.0775	0.515
	SPOTTED GAR		410		<0.50	66.7	0.717	0.0904	0.658
	AMERICAN OYSTER	T	24.2	T	0.716	1980	3.48	<0.05	1.63
	AMERICAN OYSTER		9.67		0.557	398	4.08	0.150	1.92
	AMERICAN OYSTER	A	19.1	A	0.564	1670	3.51	<0.05	1.53
4	RED DRUM		298		<0.50	77.7	1.14	0.267	1.84
	RED DRUM		133		1.53	72.7	0.716	0.314	2.21
	RED DRUM		232		<0.50	127	1.31	0.182	1.96

Table B6. Elemental residues in tissue samples from the Caernarvon Freshwater Diversion monitoring (cont.) sites for 1991 (values expressed in mg/kg, dry weight).

<u>SITE</u>	SPECIES	PARAMETER/CONTAMINANT								
		WT. (g)	%H2O	Al	Sb	Ba	Be	B	Cd	Co
4	AMERICAN OYSTER	82	88.0	216	NO	17.7	<0.10	10.6	9.10	NO
	AMERICAN OYSTER	100	86.0	262		18.9	<0.10	11.3	9.51	
	AMERICAN OYSTER	101	86.5	206	DATA	15.1	<0.10	10.7	8.12	DATA

Table B6. Elemental residues in tissue samples from the Caernarvon Freshwater Diversion monitoring (cont.) sites for 1991 (values expressed in mg/kg, dry weight).

SITE	SPECIES	PARAMETER/CONTAMINANT							
		Cr	Cu	Fe	Pb	Mg	Mn	Mo	Ni
4	AMERICAN OYSTER	0.991	295	488	<1.50	2570	38.5	<0.80	3.18
	AMERICAN OYSTER	0.944	263	526	<1.50	2750	41.1	<0.80	2.39
	AMERICAN OYSTER	0.786	246	398	<1.50	2450	35.2	<0.80	2.58

Table B6. Elemental residues in tissue samples from the Caernarvon Freshwater Diversion monitoring (cont.) sites for 1991 (values expressed in mg/kg, dry weight).

SITE	SPECIES	PARAMETER/CONTAMINANT							
		Ag	Sr	Sn	V	Zn	As	Hg	Se
4	AMERICAN OYSTER	NO	25.4	NO	0.826	2720	5.10	0.0567	3.16
	AMERICAN OYSTER		41.8		0.911	2490	5.69	0.0710	3.35
	AMERICAN OYSTER	DATA	22.7	DATA	0.778	2310	5.44	0.0524	3.05